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(54) Method of Igniting a Direct-current Welding Arc

(57) In DC, straight polarity, arc welding, proper ignition of the arc at the beginning of the welding process is achieved by reversing the polarity of the electrode and of the workpiece for a short period, and with the electrode and workpiece connected respectively to the positive and negative poles of the power source, supplying an ignition pulse between the electrode and the workpiece.

As shown, a power source 10 is connected via a pole-reversing switch 13 to an electrode 14 and workpiece 15. Pulses from the power source 10 reverse the polarity of switch 13 for a period, of less than one second, determined by a timing relay 17, and during this period power is supplied to an ignition unit 16 which ignites the arc.

The method has particular application to fully mechanised welding of light alloys, such as aluminium; in an inert-gas atmosphere (e.g. He or He/A) with a non-consumable electrode.

The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

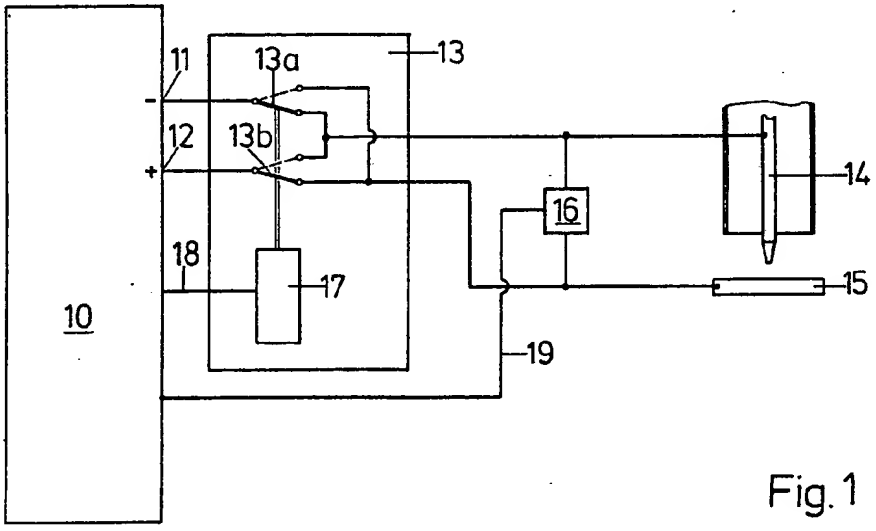

Fig. 1

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Fig. 1

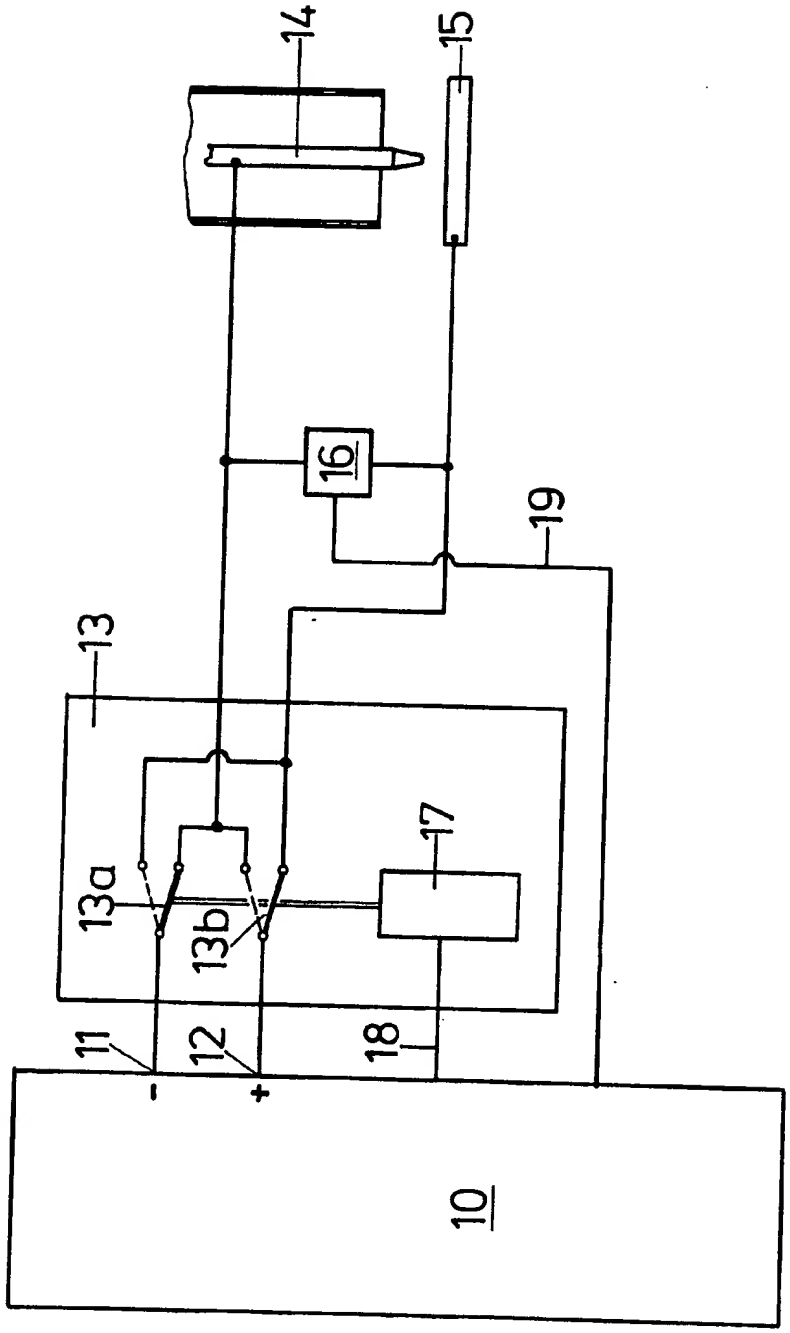
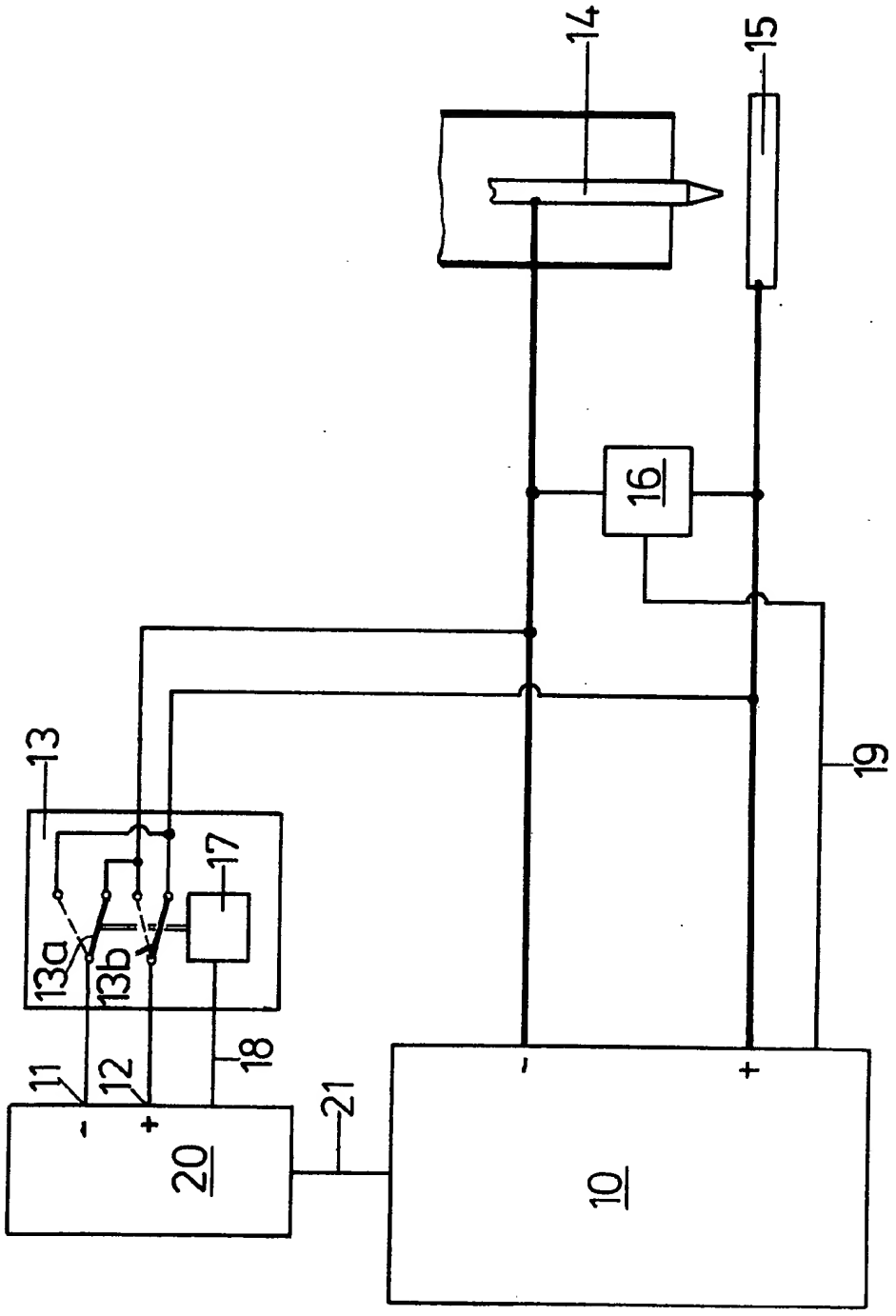


Fig.2



SPECIFICATION

Method of Igniting a Direct-current Welding Arc

The present invention relates to a method of, and to a device for, igniting a direct-current welding arc, particularly for inert-gas welding of light alloys with a non-melting electrode, in which the arc is maintained between an electrode connected to a negative pole of a power source and a workpiece connected to the positive pole of the power source.

This state of the art is known, for example, from pages 84 and 85 of brochure 35.0007, issued by the applicant in form of a handbook and entitled "Inert-gas Welding". Tests of this type of direct-current welding of aluminium with the tungsten electrode connected to the negative pole have shown that, despite the negative polarity of the electrode, the oxide skin of the aluminium to be welded is destroyed, which is thought to be due to the high concentration of heat, particularly when using helium or an argon/helium mixture as the shielding gas. Since in addition to this, higher welding speeds, less time delay, and a smaller heat-affected zone have been noted with this direct-current welding method, in contrast to alternating-current welding of aluminium, these advantages make the direct-current welding of aluminium particularly suitable for fully mechanised welding.

Especially with fully mechanised welding, however, it is necessary that the direct-current welding arc is ignited properly so that the effect of automation is not impaired, or even cancelled, by arcs which have not been ignited. Practice has shown that with direct-current welding of aluminium, a reproducible ignition behaviour cannot be achieved with the tungsten electrode at the negative pole. This is thought to be due particularly to the fact that, since the tungsten electrode is cold at the beginning of the welding process and is connected to the negative pole, the point at which an arc strikes is not fixed (at the electrode tip) but "dances about" on the surface of the electrode and moves away from the electrode tip.

Attempts have been made to improve this unsatisfactory ignition behaviour by changing the composition of the electrode, particularly by increasing the thorium content normally provided in the tungsten electrodes, but it has not been possible to achieve an improvement in the ignition characteristics by means of such electrodes.

It is an object of the present invention to improve the ignition behaviour in direct-current welding, particularly of light alloys such as aluminium, with a tungsten electrode at the negative pole, particularly to make it possible to employ the method in fully-mechanised welding installations.

To achieve this object it is proposed, according to the present invention, to reverse the polarity of the electrode and of the workpiece for a short period for igniting the arc that the electrode is connected to the positive pole and the workpiece is connected to the negative pole of the power source and, in this condition of reverse polarity, an ignition pulse is supplied between the electrode and the workpiece.

The method according to the invention produces a safe and reproducible ignition behaviour, which is thought to be due particularly to the fact that, due to the positive polarity of the electrode, at the time of supplying the ignition pulse, an arc strikes at the tip of the electrode without "dancing about". This has the effect that the electrode heats up at a point in a very short time and the generation of a stable arc is made possible.

It has been shown to be particularly advantageous for the polarity-reversing period to have a duration of only seconds, and particularly less than one second. The period of polarity reversal is determined by the type of shielding gas and the electrode diameter and by the welding current set, the duration of polarity reversal being less with low welding currents and smaller electrode diameters than with low welding currents and electrodes with larger diameters.

In the description which follows, particularly advantageous devices for carrying out the method are explained in greater detail with the aid of Figures 1 and 2. In Figures 1 and 2, 10, 20 designate a power source the positive and negative poles of which are marked 11 and 12, respectively. The positive and negative poles 11, 12 are connected via a pole-reversing switch 13 to a non-melting welding torch electrode 14 and a workpiece 15. In addition, the electrode 14 and the workpiece 15 are connected to an ignition unit 16. The design of the power source 10 and the design of the torch 14 and that of the ignition unit 16 is generally known and not further explained for this reason. For example, a power source sold by the applicant under the name of MULTIWIG can be used as the power source 10. The ignition unit can be an electronic pulse generator according to German Patent 16 15 363. The pole-reversing switch 13 has two switching contacts 13a, 13b which are actuated by a timing relay 17 in dependence on control pulses (line 18) from the power source 10, 20, 19 designates a line for actuating the ignition unit 16. In Figure 1, ignition is effected via the power source 10. In order to be able advantageously to employ a pole-reversing switch 13 for smaller outputs, in the embodiment example according to Figure 2 the ignition is effected via an auxiliary power source 20, and this power source 20 need be designed only for the ignition output. After polarity reversal of the auxiliary power source 20, the main power source 10 is then connected, via a control line 21, for the welding.

In the position of the switching contacts 13a, 13b shown in Figures 1 and 2, the negative pole 11 of the power source is connected to the torch electrode 14 and the positive pole 12 of the power source is connected to the workpiece 15.

The contacts 13a, 13b, therefore, are in the "welding p sition".

According to the present inventi n, for the purpose of igniting the arc the polarity of the electrode 14 and of the workpiece 15 is reversed, for which purpose a pulse is fed via the line 18 to the timing relay 17 which causes the contacts 13a and 13b to be placed into the dashed position (ignition position). In order to trigger the ignition process, an appropriate pulse is fed via the line 19 to the ignition unit 16 which causes this latter to be operated and ignition pulses to be fed to the electrode 14 and the workpiece 15. The polarity-reversal of the electrode 14 and the workpiece 15, produced for ignition, is in the region of fractions of one second, this period of polarity-reversal being adjustable, for example at the timing relay 17 or at the power source 10. After ignition has been effected, the contacts 13a, 13b are brought again into the "welding position", via timing relay 17 and pole-reversing switch 13, and in the example according to Figure 2, the power source 10, switched to the "welding position" is connected.

Claims

1. Method of igniting a direct-current welding arc, in which the arc is maintained between an electrode connected to a negative pole of a power source and a workpiece connected to the positive pole of the power source, characterised in that the polarity of the electrode and of the workpiece is reversed for a short period for igniting the arc, so that the electrode is connected to the positive pole and the workpiece is connected to the negative pole of the power source and in this condition of reverse polarity an ignition pulse is supplied between the electrode and the workpiece.

2. Method according to claim 1, characterised in that the duration of pole-reversal is less than one second.

3. Method according to claim 1 or claim 2 applied to the inert-gas welding of light alloys with a non-melting electrode.

4. Method according to claim 3 applied to the welding of aluminium.

5. Method according to claim 4 and in which the welding is fully mechanised.

6. Device for carrying out the method according to any preceding claim characterised by a power source which has positive and negative poles respectively connected via a pole-reversing switch to a non-melting welding-torch electrode and to a workpiece, and also by an ignition unit connected to the electrode and the workpiece.

7. Device according to claim 6, characterised in that the pole-reversing switch is provided with a timing relay.

8. Device for carrying out the method of any of claims 1 to 5, characterised in that, an auxiliary power source to which, after ignition has been effected, a power source can be connected for the welding, is provided for the ignition, and in that, furthermore, the pole-reversing switch is connected to the output of the auxiliary power source.

9. Method of igniting a direct-current welding arc substantially as hereinbefore particularly described and as illustrated in the accompanying drawings.

10. Device for igniting a direct-current welding arc substantially as hereinbefore particularly described and as illustrated in the accompanying drawings.

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